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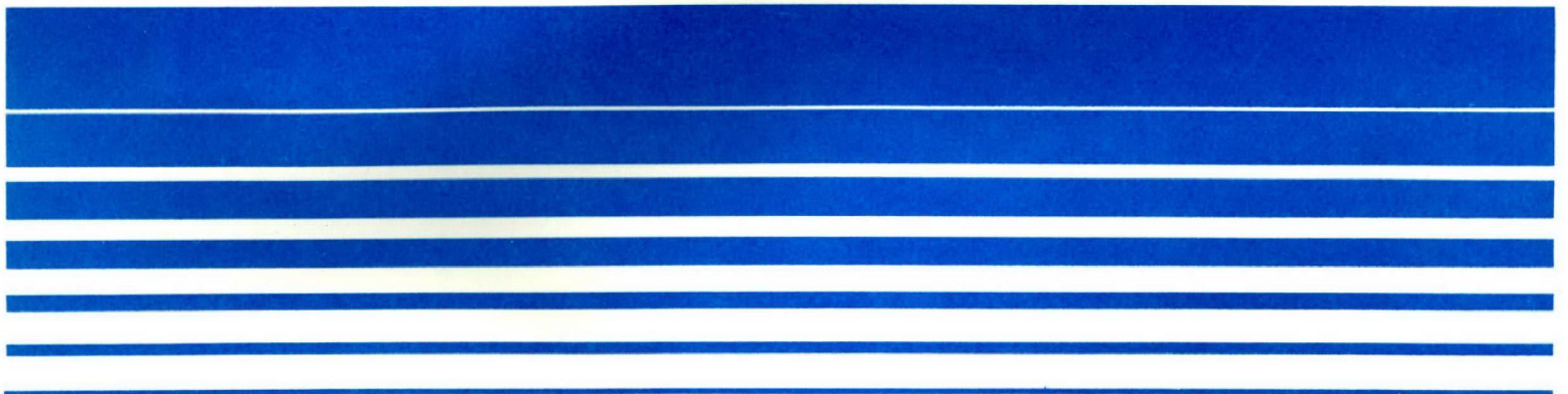
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Air



Employee Commute Options Guidance



1.0 Introduction

The Clean Air Act Amendments of 1990 (CAAA) require severe and extreme ozone nonattainment areas and serious carbon monoxide nonattainment areas to establish programs aimed at reducing commute trips to the worksites of large employers. The concerns that lead to the inclusion of this Employee Commute Options (ECO) provision in the Act are that more people are driving than ever before and they are driving longer distances. Traffic congestion has increased significantly as a result. Moreover, the increase in congestion exacerbates the emissions impact of the increased number of vehicle miles traveled.

The increase in drivers and the increase in the number of miles traveled currently offset a large part of the emissions reductions achieved through the production and sale of vehicles that operate more cleanly. It is widely accepted that shortly after the year 2000, the increased emissions caused by more vehicles being driven more miles under more congested conditions will outweigh the fact that each new vehicle pollutes less, resulting in an increase in emissions from mobile sources. The legislative history of the employer trip reduction provision includes the following statement:

"If we are ever to reduce or even simply avoid increases in vehicle pollution, it is not enough to control only the pollution which each car emits. The use of the car must be examined as well because the growth in vehicle miles

traveled threatens to overwhelm what can be achieved through even the toughest tailpipe standards. ... [The provision is] intended to reduce future growth of vehicles miles traveled, but at the same time provide enhanced mobility to serve ever increasing travel demands."

The first trip reduction programs in the country were designed to reduce congestion. Since 1982, approximately 55 Trip Reduction Ordinances (TRO) have been enacted in the United States. One such program was established in the City of Pleasanton, California. Established in October 1984, this TRO was designed to reduce peak hour traffic by 45%. As air pollution became more of an issue in some areas, TRO's were implemented to improve air quality not only traffic congestion. In July of 1988, the South Coast Air Quality Management District in California passed Regulation XV designed to reduce emissions from vehicles operating between 6:00 am and 10:00 am on weekdays. Three Average Vehicle Ridership (AVR) targets, based on location within the District were designed to result in approximately a 25% increase in average vehicle ridership in the Los Angeles, San Bernardino, Orange and Riverside Counties. The term Average Vehicle Ridership is comparable to the term average vehicle occupancy (AVO), as used below in this guidance.

2.0 The Purpose of This Guidance

The purpose of this guidance is to inform the affected State and local jurisdictions of the Clean Air Act requirement, to provide guidance on preparing an approvable State Implementation Plan

(SIP) revision, and to discuss various approaches which may help areas achieve Clean Air Act targets through implementation strategies that are the least burdensome and costly to both affected employers and employees.

This guidance is intended to assist States in developing approvable SIP revisions, but does not establish or affect legal rights or obligations. It does not establish a binding norm and it is not finally determinative of the issues addressed. EPA approval of any particular SIP revision will be made by applying the applicable law to the specific provisions in the SIP.

This guidance was initially to be included in the General Preamble to Title I of the Clean Air Act [57 FR 13498, April 16, 1992]. As a part of the preparation of that document, this guidance went through an informal comment period which included a public meeting held June 25-26, 1991 in Reston, Virginia. An announcement of this public meeting was published in the Federal Register. In addition, several drafts of the guidance were sent to a wide spectrum of interested parties for comment including a review panel for The National Association of Regional Councils. Subsequently, it was decided that this guidance would be published separately from the General Preamble.

3.0 The Clean Air Act Requirement

Section 182(d) (1) (B) requires that States with severe and extreme ozone nonattainment areas shall submit a SIP revision requiring employers with 100 or more employees in such areas to implement programs to reduce work related vehicle trips and miles traveled by employees. At a minimum, the SIP revision shall require that each employer increase its average passenger occupancy per vehicle (APO) in commuting trips between home and the workplace during peak travel periods "by" (or in EPA's interpretation of the intended meaning, "to a level") not less than 25% above the average vehicle occupancy (AVO) for all such trips in the nonattainment area at the time the SIP revision is submitted.

(The AVO refers to the baseline for the nonattainment area or for a zone within the nonattainment area if it is divided into zones. The APO applies to employers.) The SIP revision shall be submitted no later than November 15, 1992. The revision shall require that within 2 years after the date the SIP revision is submitted, employers must submit compliance plans that convincingly demonstrate that compliance will be achieved no later than four years after the SIP revision is submitted. Section 187(b) (2) requires that States with serious CO nonattainment areas also adopt such programs.

EPA interprets Section 182(d) (1) (B) of the Act to mean that each State with a severe or extreme ozone nonattainment area or a serious carbon monoxide nonattainment area will establish a

process of compliance plan submission, approval, periodic reporting on target achievement, and periodic compliance plan revision that aims at the required target.

Areas that have trip reduction programs in effect, either mandatory or voluntary, that are anticipated to produce significant increases in the area AVO in the short term have expressed concern that establishing 1992 as the base year will penalize them and will discourage employers from cooperating with current programs. Where such programs are fully implemented and meet all requirements for an approvable SIP under Sections 110 and 182 of the CAAA, the areas may, if they have not already, make a complete SIP submittal and receive full EPA approval. By electing to use an earlier SIP submittal, such areas will be able to recognize the AVO increases resulting from the ongoing efforts of their program.

States with marginal, moderate, or serious ozone nonattainment areas or with moderate CO nonattainment areas are not required to implement an employer trip reduction program as outlined in Section (d) (1) (B). They may, however, elect to implement such a program and to follow this guidance. Reductions in emissions from the ECO program in such areas may receive SIP credit toward required emission reduction demonstrations, provided that certain criteria relating to quantification, permanence, and

enforceability of credits are satisfied. Emission reduction estimation techniques will be addressed in a separate guidance.

4.0 Definitions

Definitions of several terms are not provided in the Act itself but are needed to establish the parameters of employee commute options programs. States developing ECO SIP submissions may use the following interpretive definitions or may document that alternative definitions are more appropriate.

"Peak travel periods" refers to the those hours between which the morning commute occurs Monday through Friday. EPA believes that the intent of the Act is to significantly reduce single occupancy vehicle commute trips to and from work and has defined the peak travel periods to include either the hours between 6:00 a.m. and 10:00 a.m. or any other period which captures 85% of commute trips between 5:00 a.m. and 11:00 a.m. as determined by the State.

"Work-related trips" and "commuting trips between home and the workplace" include trips with stops en route to work during the peak travel periods.

"Vehicle" refers to a highway vehicle powered by a gasoline or diesel internal combustion engine with fewer than nine seating positions for adults. States may propose, in their SIP

submissions, factors to be applied to the vehicle count which would reflect the lower emission levels from alternatively fueled vehicles if they are certified by a government authority as being substantially lower emitting in actual use than vehicles generally purchased in the area. EPA will work directly with interested States on the development of such factors.

Although the statutory language does not explicitly allow alternatively fueled vehicles to receive less than the full count of a regular gasoline or diesel fueled vehicle, it is clearly the intent of the Act as a whole to promote technologies that reduce emissions. Therefore, EPA feels that certain alternatively fueled vehicles known to be lower emitting in actual use than other vehicles arriving at the worksite, may be exempted from counting as a full vehicle.

"Employee" means any person employed by a firm, person(s), business, educational institution, non-profit agency or corporation, government department or agency or other entity, in a full-time or part-time position who either reports to work or is assigned primarily to a worksite 80 or more hours per 28-day period in either a permanent or temporary capacity, on either a contract or employed basis, excluding volunteers. States may set up a de minimis level for "temporary capacity," for example, a period of one month or less or a different period that is equally

appropriate as applied to the area's employment practices and ambient air quality conditions.

"Employer" means any person(s), firm, business, educational institution, government department or agency, non-profit agency or corporation, or other entity which employs 100 or more persons at a single worksite. Only such worksites are subject to the trip reduction requirement; smaller worksites of the same employer are not subject to the trip reduction requirement. Several subsidiaries or units that occupy the same worksite and report to one common governing board or governing entity, are considered to be one employer.

EPA interprets that it was Congress' intent to target employers who have enough employees arriving in the peak period to establish a viable ECO program. Congress selected a threshold of 100 total employees, presumably with an awareness that for the many employers near this threshold there would be fewer than 100 employees arriving during the peak period itself since some employees will work other schedules. However, there is no indication that Congress meant the 100 employee criterion to be applied rigidly in situations in which the majority of an employer's workforce follows a non-standard schedule, and the number of employees arriving in the peak period is both small enough to be considered de minimis and small enough to make ridesharing and special employer-provided services difficult. An

employer of 100 workers split evenly between three shifts would have about 33 employees arriving during the peak period. It is EPA's judgment that fewer than 33 employees who report to work during the peak travel period do not constitute enough employees commuting at that time for an employer to implement a viable trip reduction program and that such a situation is de minimis. Therefore, a de minimis exemption may be made at the State's option whereby employers with worksites at which fewer than 33 employees report to work during the peak travel period are not subject to the requirements.

Except provided for in the immediately preceding paragraph, in determining the number of its employees, an employer includes all employees from all shifts, seven days a week, not only those who commute during the peak travel period for that worksite. The number of employees an employer has is determined as the number of employees on the payroll (excluding temporary employees whose term of employment was below the de minimis threshold as averaged over a year-long period).

"Worksite" means a building, or grouping of buildings located within the same nonattainment area, or in the same AVO zone of the nonattainment area if it is divided into AVO zones, which are in actual physical contact or separated only by a private or public roadway or other private or public right-of-way, and which

are owned or operated by the same employer or by employers under common control as described under the employer definition.

5.0 SIP Submittal

5.1 Introduction

The Act requires that States submit an ECO SIP revision not later than November 15, 1992. The ECO SIP needs to include the following:

- the AVO for the nonattainment area or for each zone if the area is divided into zones,
- the target APO which must be no less than 25% above the AVO(s),
- a process for compliance demonstration, and
- enforcement procedures to ensure submission and implementation of compliance plans by subject employers.

5.2 AVO Calculation

The baseline AVO may be estimated by simply dividing the number of employees who report to worksites or other related activity centers between the peak period inclusive Monday through Friday by the number of vehicles in which these employees report over that five-day period. A telephone survey, employer administered

survey, and/or available census data may be used to determine the AVO. Statistical sampling is acceptable.

If a survey is used to estimate the AVO, it should cover a typical five-consecutive-weekday period, excluding any holidays, and should occur during a time without holidays bordering the weekend on either side of the selected week. For example, the week before Labor Day weekend should not be considered a typical week. If the ECO program specifies a season for determining employer APO (see below) the AVO should be determined so as to include the same season.

The Act states that the AVO applies to all commuting trips between home and the workplace during the peak travel period. Therefore, all commuters including those who work for employers with less than 100 employees and who commute during the peak travel periods must be included in this estimation.

The Act states that the AVO is for "such trips in the area at the time the [SIP] revision is submitted." The AVO may be estimated prior to the SIP submittal so long as the estimation includes a projection of the estimated AVO for the time the SIP revision is submitted. EPA interprets the time of SIP submittal to encompass a period up to a year prior to the date of SIP submittal.

Each State or local jurisdiction calculating the AVO for its nonattainment areas should work in close cooperation with local governments as outlined in Section 174 of the Clean Air Act. Each State or other lead agency will also decide whether nonattainment areas will be subdivided into AVO zones and how such determinations will be made. The AVO and target APO for each area and zone will be included in the SIP revision due November 15, 1992.

5.3 APO Calculation

The target APO for employers is not less than 25% above the AVO. The APO for each employer with 100 or more employees may be calculated as the number of employees reporting to the worksite during the peak travel periods inclusive Monday through Friday divided by the sum of the number of vehicles in which employees report during those peak travel period plus or minus any APO credits.

$$\text{APO} = \frac{\# \text{ employees reporting to worksite during peak period}}{\# \text{ vehicles in which employees report } \pm \text{ APO credits}}$$

This guidance allows States to provide for vehicles that are lower emitting than those generally purchased in the area to count as a percentage of a vehicle, as a measure to help make this program more cost effective without compromising the statutory requirement.

Average vehicle occupancy and employer APO compliance may be determined during the ozone season that occurs during the summer months in cold climate regions, or on a year-round basis at the State's option. States may choose, for example, to have all employer compliance surveys conducted during the summer for areas where summer is the only ozone season, or may allow such surveys to be distributed throughout the year. In the latter case, although one employer may submit its plan at a different time of year than another employer, each employer would be on a 12 month or 24 month plan submittal cycle. This would allow employers to have their compliance reports and next-cycle plans due at the same time of year each year their plans are due.

5.4 Compliance Demonstration Process

State or local law must establish ECO requirements for employers with 100 or more employees at a worksite within severe and extreme ozone nonattainment areas and serious carbon monoxide areas. Automatic coverage of those employers should be included in the law. In addition, States should develop procedures for notifying employers regarding the ECO requirements.

Finally, States and/or local laws must require that initial compliance plans "convincingly demonstrate" prospective compliance. Approval of the SIP component addressing the ECO provision will depend on the ability of the State/local regulations to ensure that the CAAA requirement that initial

compliance plans "convincingly demonstrate" compliance will be met. This demonstration can take on any of four forms or any combination of these.

One option is for the State to include in the SIP evidence that agency resources are available for the effective plan-by-plan review of employer-selected measures to ensure the high quality of compliance plans, and that plans that are not convincing will be rejected.

A second option is for the regulations in the SIP to contain a convincing minimum set of measures that all employers must implement. These measures will be subject to review and approval by EPA as adequate when the SIP is processed.

A third option is for the regulations in the SIP to provide that failure by the employer to meet the target APO will result in implementation of a regulation-specified, multi-measure contingency plan. This plan will be reviewed by EPA as for adequacy when the SIP is processed.

A fourth option is for the regulations in the SIP to include for employers who fail to meet the target APO financial penalties and/or compliance incentives that are large enough to result in a significant prospective incentive for the employer to design and implement an effective initial compliance plan of its own.

In addition, States and local jurisdictions need to include in their ECO regulations penalties and/or compliance incentives for an employer who fails to submit a compliance plan or an employer who fails to implement an approved compliance plan according to the compliance plan's implementation schedule. Penalties should be severe enough to provide an adequate incentive for employers to comply and no less than the expected cost of compliance.

5.5 Implementation Approaches

It is very important that State and local jurisdictions design a system that achieves local goals in the lowest cost manner. EPA has based much of the previous discussion on the program in Southern California, but it encourages States and local jurisdictions to seek innovative methods which may produce lower cost results. The averaging, trading and banking options, discussed in section 5.7, have not been used in California during the first years of the program, but are examples of features which may lower the overall cost of compliance.

5.6 AVO Zones

Where there are important differences in terms of commute patterns, land use, or AVO, the States may establish different zones for the calculation of AVO.

5.7 Averaging, Banking and Trading

EPA believes that States or local governments may wish to allow employers in the same nonattainment area to aggregate APO credits through averaging, banking and trading as discussed below.

Section 182(d)(1)(B) can be interpreted to allow aggregation of APO credits among employers so long as each employer increases average passenger occupancy per vehicle to a level not less than 25% above the AVO, considering any trading. The statutory language merely requires each employer to increase APO, and does not specify that the required increase in APO must come from a given employer's own employees. Consequently, the statutory phrase "commuting trips between home and the workplace" can be interpreted to refer to the trips by any employees in the area rather than only the employees of a specific employer. Any State or local jurisdiction that elects trading and banking options must ensure that an effective tracking system is implemented and maintained to ensure the integrity of such a credit system.

Programs that incorporate provisions to allow averaging or trading of emissions generally lower the cost of achieving given emission reduction targets by shifting the emissions reductions to the sources that can reduce emissions the most efficiently.

Averaging: An employer with more than one worksite in a nonattainment area may average its APO across those worksites in the nonattainment area. If the nonattainment area is divided

into zones, the employer may only average those worksites within each zone (unless as described below average commute miles values for each worksite are applied in banking or a trade). The average APO is calculated by adding all of the employees at all of the worksites in the numerator and dividing by all of the vehicles in which these employees report to the worksites. If averaging across worksites is allowed, each compliance plan should still be worksite specific.

APO Credit: In order to implement trading or banking in an ECO program, the State will need to create a unit of APO credit that can be banked or traded and can be used to meet the APO targets. Employers can readily calculate the maximum number of vehicles that may arrive at their worksite by dividing the number of their employees arriving at the worksite during the peak period by the target APO. In their simplest form, APO credits available for averaging, banking or trading would be based on the number of vehicles below the maximum allowed in order to meet the target APO. If credits are defined so simply, the ECO regulations must have some provisions, for example case by case review of proposed trades or objective criteria for determining which employers may trade with each other, to ensure that trades result in substantially the same reduction in vehicle use and emissions as if the trade had not occurred. Alternatively, States may include in their definition of their APO credits a factor for the average commute miles of an employer's employees. An employer could

establish standard distances from each worksite based on zip codes, and from these establish the roundtrip commute distance for each employee.

When an employer exceeds the target APO, the employer has managed to have fewer vehicles arrive at the worksite than the maximum allowed to meet the target APO. Multiplying the number of vehicles that could have arrived at the worksite but did not by the average commute miles of the employees results in vehicle mile credits that an employer may bank or trade. Vehicle mile credits are APO credits that take into account the distance commuted to work by an employer's employees.

For example, assume Employer A had 20 fewer vehicles arriving at the worksite than were allowed in order to meet the target APO. The average commute miles for employer A's employees is 10 miles. Employer A would have 200 vehicle mile credits available to bank or trade. Employer B has exceeded the number of vehicles that can arrive at the work place by 5. Employer B's average commute is 20 miles. Employer B can then purchase 100 vehicle miles credits from employer A in order to meet the target APO. It should be noted that an employer who does not bank or trade credits to demonstrate compliance is not required to consider the distances traveled by its own employees.

The State or local government law may allow employers to bank APO credits to be applied to future compliance demonstrations. It is EPA's position that in terms of public health benefits, early reductions achieved through banking of APO credits offsets later application of banked credits because as the fleet turns over and cleaner fuels are employed each vehicle trip generates less emissions. EPA believes that the use of the banked APO credits will not materially affect attainment by the required date. EPA recommends that State and local jurisdictions encourage banking of APO credits because of the immediate reductions in emissions that are realized through such a program.

No portion of a nonattainment area can be exempt from employer requirements as stated in Section 182(d)(1)(B). However, within a nonattainment area, certain employers may have a measured APO below the target APO and acquire APO credits to meet the target. Full documentation of the traded APO credits should be supplied. Unused APO credits may be traded more than once.

6.0 Costs and Benefits

EPA suggests that States, local jurisdictions and employers carefully consider the strategies outlined in this guidance to minimize the costs of complying with ECO targets. The strategies that can minimize the social costs of ECO include, for example, the trading of AVO reduction credits and the use of AVO zones within the nonattainment area. The two main factors to consider

in determining the net costs of the ECO program are the social costs of ECO, which is related to the expenditures which employees and/or employers must make, and the benefits of the program. (A detailed explanation of ECO program cost estimation is included in an attached appendix.)

In estimating the costs of ECO it is important to distinguish between expenditures and social costs. Employers' and/or employees' expenditures do not equal the total social costs, because part of these expenditures are "transfers" of resources from one party to another. The social costs include the value of the additional time, effort and inconvenience that commuters experience when they reduce motor vehicle use with a resulting increase in their employer's APO.

A rough estimate of the total direct social cost of the ECO program for the 11.7 to 13 million employees who work for covered employers in the ten major nonattainment areas is \$1.2 to \$1.4 billion per year.¹ This estimate is based on evidence that compensation of \$6.17 per day is representative of the cash incentive employees who forego the use of their single occupancy

¹This range is a function of two variables -- the number of employees affected, and the current percentage of solo drivers assumed. The \$1.2 billion dollar estimate assumes 11.7 million affected employees based on figures provided by the nonattainment areas subject to ECO and a 73% drive alone rate based on 1990 Census statistics. The \$1.4 billion dollar estimate assumes 13 million affected employees based on 1986 Census data for the number of employees in the nonattainment areas subject to ECO multiplied times 45% (the percent of all workers who work for employers with more than 100 employees in the Chicago metropolitan area.) The \$1.4 billion dollar estimate also assumes a national drive alone rate of 75% based on a 1987 report by the ENO Foundation for Transportation, Inc.

vehicle would have to receive in order for employers to achieve a 20% reduction in automobile use. This compensation estimate is derived from studies of commuter choices in downtown Los Angeles. It is uncertain how closely these represent conditions in the other affected nonattainment areas. (See complete discussion and explanation of methodology in Appendix.)

EPA believes that the establishment of ECO programs may yield important benefits, beyond the obvious one of emission reduction. ECO programs will reduce the use of single-occupant automobiles for commuting by employees working at covered employers, potentially reducing congestion, fuel use, and commuting time for all motorists still using the highways during the commute period, including noncommuters. (The values of changes in congestion, fuel use, and time for employees who make a switch are reflected in the estimate of \$6.17 per day.) Also, less need for parking space may release valuable real estate for alternate uses. In addition, states may use the reductions in emissions in achieving compliance with their nonattainment areas' reasonable further progress and VMT offset requirements, thereby avoiding the cost of other measures which would have been needed.

Extrapolating from recent work by Shoup and Wilson², the value of commuting time reductions may be estimated to range from

² Donald C. Shoup and Richard W. Wilson "Commuting, Congestion, and Pollution: The Employer-Paid Parking Connection" prepared for and presented at the Congestion Pricing Symposium, May 1992.

approximately \$447 - \$511 million dollars annually³. This social cost savings combined with the uncalculated pollution benefits, at least partially, offsets the \$1.2 to \$1.4 billion cost. However, this estimate of time savings is only an approximation, as the true savings depends on the subjective value commuters place on time savings, and on the specific relationships between reduced road volume and time savings on the many roadways that may be affected. Moreover, additional uncertainty in estimating time savings (and emission reductions) arises from the possibility that reduced congestion and shorter commuting times may lead some employees of non-covered employers to switch away from transit or car pools back to single-occupant vehicles. As a result, VMT and commute times stabilize at higher values than if there had been no such "latent demand" effect (but still no higher than without the ECO program under any circumstance).

7.0 Best Practices

Because various trip reduction programs including transportation demand management (TDM) programs have been in place for almost ten years, there is some experience to draw on for employers who are subject to the ECO provision.

³ Shoup and Willson estimate that each vehicle represents \$262 dollars in congestion-related social costs. The \$262 cost per vehicle for each additional car on the road reflects an increase in: 1) accidents 2) time/cost of congestion 3) fuel costs. \$447 million = 11.7 million (affected workers) x .73 (percent of drive alone based on 1990 Census) x .20 (percent that need to switch) x \$262. \$511 million = 13 million (number of employees in nonattainment areas subject to ECO x .45) x .75 (percent of drive alone based on 1987 ENO Foundation report) x .20 (percent that need to switch) x \$262.

There are a number of factors that are commonly found at companies with successful programs. These include:

- Support of both upper and middle management
- Appointment of a qualified and committed employee transportation coordinator (ETC)
- Effective market research on the commute patterns of employees and transportation options available to employees
- Selection of an appropriate and effective set of measures including incentives and disincentives to encourage employees to select non drive-alone modes.

There are many considerations to take into account when an employer selects measures to put into a compliance plan. Key among these include: the availability of parking, the cost of parking, and the availability of mass transit. Of course each worksite is unique and an effective program is designed to meet the needs of employees at each particular worksite.

Some examples of measures employers may include in compliance plans are listed below. This list is not all-inclusive and the measures are not required per se.

- 1) Offer cash incentives
- 2) Cashing out parking⁴

⁴ An employer offers to provide a cash allowance to an employee equivalent to the parking subsidy that the employer would otherwise pay to provide the employee with a parking space.

- 3) Institute compressed work weeks
- 4) Charge those who drive alone for parking
- 5) Sponsor and/or subsidize carpools and vanpools
- 6) Subsidize use of public transit
- 7) Provide comprehensive rideshare matching service
- 8) Subsidize mid-day shuttles to local shopping areas
- 9) Provide company-owned vehicles for ridesharing
- 10) Offer preferential or subsidized parking for carpools and vanpools
- 11) Provide a guaranteed ride home program
- 12) Improve facilities to promote bicycle use
- 13) Promote establishment of on-site amenities
- 14) Offer telecommuting and work-at-home options

In February 1990, the Federal Highway Administration (FHWA) published the "Evaluation of Travel Demand Management Measures to Relieve Congestion." The goal of the study was to determine whether particular TDM efforts have had a measurable impact on traffic volumes. In reviewing TDM programs in different regions of the country, 11 employers were selected for case studies. Determination of the percent of vehicle trips reduced was used as the measure of success for each program. Based on this criterion, several of the employers selected were very successful in their TDM programs. The study concludes that TDM can reduce low occupancy vehicle trips to a site and that the degree of success is directly determined by the specific components of the TDM program.

The FHWA study also examined the factors which contributed to successful programs. Employer size and the density of development around an employer's site were not factors which predicted the success of a company's efforts. One of the most powerful indicators of program success was the offering of transportation allowances or subsidies. Parking also plays a critical role in influencing commuter behavior. Charging for parking and/or restricting access to parking provide a disincentive to solo-driving, but may also result in a cost reduction or savings to the employer.

The top three employers in FHWA's study all had restricted parking and charged for parking. It appears that a very effective approach is for an employer to implement an appropriate combination of transportation allowances or subsidies, parking charges, and parking restrictions. This approach may be the most economic for employers as well if the parking charges exceed the real cost of parking and are applied toward the subsidies given to employees who use non drive-alone modes. One employer supplied all employees with a monthly \$40 transportation allowance regardless of how they arrived at work. Parking was restricted and employees driving alone were charged \$40 for parking although this was above the actual cost of parking to the employer. The parking revenue was committed to finance direct subsidies to carpoolers and transit users. Transit users were given a \$15 monthly pass discount and carpoolers were given a

free parking space, both in addition to the \$40 transportation allowance. By restricting parking and charging for parking, providing a transportation allowance, and subsidizing high occupancy modes, this employer succeeded in shifting the drive alone percentage of its employees from 89% in December 1986 to 54% in January 1988. This is a significant shift in just over a year's time.

Among the employers studied in the FHWA study, complete cost data were available for only four of the eleven sites. The two most effective programs were the only ones among the top five to have cost information available. Interestingly, based on the net cost of the TDM program, both employers came out ahead as a result of implementing their TDM programs. Clearly, this does not indicate that all successful ECO programs will result in a negative net cost to the employer. However, it does demonstrate that there will likely be some employers among those who implement cost effective measures to comply with the ECO provision of the Clean Air Act who do so without enduring an undue economic burden.

Additional information about strategies that employers may use in implementing the ECO requirements in the Clean Air Act may be found in the U.S. EPA document, "Transportation Control Measure Information Documents," published by the Office of Mobile Sources in May, 1992.

APPENDIX A
METHODOLOGY FOR ROUGH ESTIMATION OF ECO SOCIAL COSTS

The discussion below outlines the derivation of a rough estimate of the social costs for the ECO program.

A key part of the costs of ECO program is the additional time, inconvenience and expense that workers who drive to work would incur if they had to commute by other means. A standard economic approach to estimating such costs is to assume direct cash compensation is offered to reduce employee car use for commuting. Although many employers may achieve ECO goals by other means, there is no reason to believe that these will on average be more efficient, since none provides the same flexibility to workers that they may have under cash compensation.¹ Estimation using direct compensation may use empirical evidence which shows how commuter mode choice changes in response to the various costs of commuting. However, it may also be noted that the Clean Air Act, as interpreted by EPA, does not make achieving the AVO target enforceable or make employers begin with particular incentives unless the State chooses to do so. It is possible, therefore, that not all of the annual costs estimated above will begin to occur right away. The approach used here considers the social costs of ECO in two parts; (i) the costs borne by workers who reduce car use in order to achieve ECO goals; (ii) the costs incurred for program implementation and administration.

Costs borne by Workers who Reduce Car Use:

The direct compensation that employers must pay employees to reduce commuting by automobile can be used to measure the social cost incurred by these employees as they adopt other, less-preferred means of getting to work. To estimate the direct compensation necessary to meet the requirement of §182(d)(1)(B) of the CAAA, empirical evidence can be used to estimate how commuters choice of travel mode depends on cost. Such evidence of commuter behavior provides a powerful tool to measure commuter's valuation of particular modes;

"(empirical data) present real world results where people have shifted their commuting modes in response to changes in the monetary costs of commuting. This method implicitly takes into account all of the factors relating to the

¹Several studies conclude that cash incentives (and/or commute subsidies) are one of the most powerful indicators of the success of employer trip reduction programs. (See: Cambridge Systematic, Inc., "Effects of Demand Management and Land Use on Traffic Congestion: Literature Review", December 1991, page 93. Prepared for USDOT, contract number DTFH61-91-C-00085. Also see: Comsis Corporation, "Evaluation of Travel Demand Management Measures to Relieve Congestion", February 1990, pages 25-27. Prepared for USDOT, report number FHWA-SA-90-005.)

advantages and disadvantages of switching from driving alone to carpooling or public transportation."²

Empirical results on the effect of direct compensation on commuting mode choice are available from research on the demand for parking by Shoup and Willson (1992).³ They used a multinomial logit analysis of commuting among office-workers in downtown Los Angeles and found that workers who had to buy parking at market prices used 17% fewer cars to commute to work than did similar workers who received employee paid parking. In their sample the market value of parking was \$4.15 per car per day in 1986 dollars, or \$5.25 in 1992 dollars.⁴ Assuming that the market demand function for parking is linear, compensation of \$6.17 per car per day would be needed to achieve the §182(d) goal of a 20% reduction in vehicle use.⁵

This estimate of direct compensation costs must be applied across the whole population of affected workers.⁶ There are two ways to estimate the number of affected employees. One approach is based on figures provided by the nonattainment areas subject to the ECO program resulting in an estimate of 11.7 million affected employees. The second estimate is derived by taking the total number of employees in the affected nonattainment areas based on 1986 Census data and multiplying it by 45%, which is the estimated percentage of employees at affected employers in the Chicago metropolitan area. The second approach results in an estimate of 13 million affected employees.

² B. Galef, E. Chu, T. Bansal, ICF Inc. Memorandum to Terri Wilsie, EPA. May 5, 1992.

³ D. Shoup and R. Willson, "Employer-paid Parking; The Problem and Proposed Solutions", Transportation Quarterly, June 1992.

⁴ Using the CPI for 1986 of 110, and for 1992 of 140, the average parking price in '92 dollars = $\$4.15 \times (140/110) = \5.25 .

⁵ The assumption of linearity is a first-order approximation of general parking demand that is valid for small changes in price. We thus extrapolate to get the price needed to induce a 20% reduction in automobile use: $\$5.25 \times (20\%/17\%) = \6.17 .

⁶ The compensation estimate of \$6.17 derived from Los Angeles commuters may or may not be representative of other ECO cities. On the one hand, since Los Angeles is one of the least compact ECO cities, we could expect that opportunities for carpooling or mass transit would be more limited than in other ECO areas. In this case, the \$6.17 would be an overestimate of the compensation needed to reduce commuting car use by 20% in other ECO cities. On the other hand, Shoup and Willson's data are from office workers in the central business district of Los Angeles. For these workers in this particular areas, the opportunities for arranging carpools or using mass transit may be greater than for the rest of the Los Angeles nonattainment area. Thus the estimate of \$6.17 would be too low for the whole Los Angeles nonattainment area. Given such offsetting effects and the lack of other comparable data, we believe it is reasonable to rely on Shoup and Willson to generalize across the other ECO cities.

The next step is to determine the number of solo drivers among the affected employees. Based on 1990 Census data, 73% of the population drive to work alone. Based on a 1987 Eno Foundation report, an estimate of the number of employees driving alone would be 75% of the affected commuters.⁷ Compensating 20% of this group to switch to non-solo driving commuting would require expenditures ranging from \$2.7 to \$3.1 billion.⁸

The social cost of this direct compensation must be calculated by netting out transfers. The amount of the transfers depends on both marginal income tax rates and the characteristics of the demand curve for automobile use for commuting. Assuming a marginal tax rate of 25%, the additional amount of taxes generated by the compensation payments ranges from \$700 million of the \$2.7 billion to \$780 million of the \$3.1 billion. This is a transfer to the government and not a social cost. Of the remaining \$2.0 - \$2.3 billion, some is a pure gain to employees, and some represents the cost to those employees who switch modes. Assuming as a first-order approximation that demand for parking is linear in the relevant range, the social cost to the workers who previously commuted by driving alone is \$1.0 - \$1.2 billion.⁹ The assumption of linearity is generally seen as appropriate; "the assumption of linear demand is a middle-ground assumption rather than one that falls at either extreme."¹⁰

Costs Due to Program Administration:

There are opportunity costs associated with the administration and implementation of ECO. Every dollar spent on commuting surveys, plan development, plan coordination, program

⁷ ENO Foundation for Transportation, Inc., "Commuting in America", 1987, p.53. They report that solo drivers account for 77.3% of metropolitan residents nationwide.

⁸ \$2.7 billion/yr = \$6.17/day x 260 working days/yr x 11.7 million workers x 73% (solo drivers) x 20% (switchers). \$3.1 billion/yr = \$6.17/day x 260 working days/yr x 13 million workers x 75%(solo drivers) x 20%(switchers).

It is important to point out that employers will have to compensate more than just the 20% of solo drivers who agree to shift modes. Employees who, pre-ECO, did not solo drive, will still demand the ECO compensation. These employees can credibly threaten to put aside their bicycles, carpools or bus passes and resume solo driving if they are not paid the same compensation as those who agree to stop solo driving only to help achieve ECO goals. These compensations, however, are transfers, and not net social costs, since these individuals do not have to change their activities in anyway. The social costs associated with these payments are the renegotiations of labor contracts that such compensation engenders. Such renegotiations are potentially costly, but the absence of data prevents any quantification of such costs.

⁹ \$1.0 billion = \$2.7 billion x 75% x 0.5. \$1.2 billion = \$3.1 billion x 75% x 0.5. The social costs to these workers would be higher if the demand curve was concave to the origin, and lower if convex.

¹⁰ ICF Memo, May 5, 1992

monitoring and employees' time is one dollar of social cost.¹¹ Preliminary assessments of trip reduction programs suggest annual administration costs of \$3500 per year for a typical firm of 200 employees. This figure averages to about \$17.50 per employee per year, or \$200 - \$230 million across all covered workers.¹² (These administrative costs at covered firms will also have labor market distortion affects, with resulting social costs. These costs are likely to be small and so are not considered in detail.¹³)

Total Social Cost:

The total social cost of this ECO program are thus estimated to fall in the range of \$1.2 - \$1.4 billion per year.¹⁴ This overview is meant to be illustrative, although parameter estimates have been used which are consistent with the data. This approach provides a reasonable estimate of the social costs of the ECO, however, States and other responsible parties are encouraged to improve upon this assessment by making further refinements.

¹¹ Actual employer ECO requirements will be determined on a State-by-State basis. However, as is common with State Implementation Plan provision, EPA will likely compel States to require firms to produce thorough and verifiable baseline surveys, trip reduction plans, and monitor compliance regularly.

¹² The \$3500 estimate is derived from estimates of: survey costs of \$300 per year (5 days x 4 hr/day x \$15/hr x 1 survey/yr); statistical analysis of survey data of \$400 per year (8 hr x \$50/hr x 1 survey/yr); employee familiarization with ECO of \$1600 per year (1/2 hour per employee x 200 employees x \$16/hr x 1 time/yr); staff management of ECO of \$1000 per year; and one-time ECO plan development of \$2000 per plan (about \$200 per year). Data showing roughly similar or higher levels of administrative costs comes from surveys of Regulation XV plans by the Chicago Area Transportation Study (F. Gerald Rawlings letters to Andrew Plummer, May 20, 1992, and June 12, 1992). One plan they reviewed for a firm of 115 employees reported annual survey costs of \$1290, one-time plan preparation costs of \$3000, and annual ECO management costs of \$4680 per year. Another firm, with 354 employees, reported one-time plan preparation costs of \$4350.50, and several thousand of dollars in annual ECO management costs.

¹³ Firms will endure an increase in the cost of employment for two reasons. First, the administrative cost of implementing ECO has a component that increases with employment, and second, the cost of compensating workers who would prefer to drive to work raises costs above what they would otherwise be. Preliminary investigations of the magnitudes of these costs indicate that they are likely to be low relative to the total costs of ECO.

¹⁴ The total social cost equals the tax transfer and the pure gain subtracted from the expenditures required to switch solo drivers to a non-SOV mode plus the administrative costs. \$1.2 billion = \$2.7 billion - \$700 million - \$1.2 billion + \$200 million. \$1.4 billion = \$3.1 billion - \$780 million - \$1.1 billion + \$230 million.